CLAIMS

1. A heat exchanger, wherein

a plurality of substrates that have a plurality of long plates arranged in parallel, slits disposed between the long plates, and recesses longitudinally continuously disposed in one-side main surfaces of some of the long plates are stacked,

the long plates of the adjacent substrates are interconnected to form tubes,

the recesses form tube internal flow channels, and

the slits form tube external flow channels.

2. The heat exchanger of claim 1, wherein,

substrates having a plurality of long plates arranged in parallel and slits disposed between the long plates, and other substrates having a plurality of long plates arranged in parallel, slits disposed between the long plates, and recesses disposed longitudinally continuously in one-side main surfaces of the long plates are alternately stacked.

3. The heat exchanger of claim 1 or claim 2, wherein,

holding plates for holding the long plates at the both ends of the long plates and long holes formed inside the holding plates are disposed on the substrate,

extensions of the recesses formed in one-side main surfaces of some of the long plates communicate with the long holes,

the long holes in the adjacent substrates are interconnected to form branch flow channels, and

the tube internal flow channels formed of the recesses are connected to the branch flow channels.

4. The heat exchanger of claim 1 or claim 2, wherein,

thickness of some of the long plates is set to be smaller than that of the holding plates,

clearances are formed between the tubes also in a stacking direction of the substrates, and

tube external flow channels are formed also between the substrates.

5. The heat exchanger of claim 1 or claim 2, wherein,

the substrates are made of resin.

6. The heat exchanger of claim 3, wherein,

lids for covering the long holes are disposed at opposite ends of the stacked substrates, and part of the lids has one of an inflow tube and an outflow tube.

7. The heat exchanger of claim 4, wherein,

fluid in the tube external flow channels is made to flow in a plane direction the substrates.

8. A manufacturing method of the heat exchanger of claim 1 or claim 2, wherein,

the substrates are bonded and stacked by welding.

9. A heat exchanger comprising:

a plurality of first substrates having first slits and second slits disposed in parallel; and

a plurality of second substrates that have third slits with a shape identical to that of the first slits, and of which longitudinal length is shorter than length of the second slits,

wherein,

the first substrates and the second substrates are stacked so that the first slits of the first substrates communicate with the third slits,

the first slits and the third slits form tube external flow channels, and

the second slits and the second substrates form tube internal flow channels.

10. The heat exchanger of claim 9, wherein,

the first substrate is sandwiched between the second substrates.

11. The heat exchanger of claim 9 or claim 10, wherein,

the first slits and the second slits are alternately arranged.

12. The heat exchanger of claim 9 or claim 10, wherein,

the plurality of first substrates are sandwiched between the second substrates.

13. The heat exchanger of claim 9 or claim 10, wherein,

the tube internal flow channels are enlarged in the substrate stacking direction on an inflow side of external fluid.

14. The heat exchanger of claim 9 or claim 10, wherein,

an inlet and an outlet of the tube internal flow channel are extended in the direction of the tube external flow channel.

15. A manufacturing method of the heat exchanger of claim 9 or claim 10, wherein,

at least one of the first substrate and the second substrate is processed by pressing.

16. A manufacturing method of the heat exchanger of claim 9 or claim 10, wherein,

at least one of the first substrate and the second substrate is processed by etching.

17. A manufacturing method of the heat exchanger of claim 9 or claim 10, wherein,

the first substrates are bonded to the second substrates by thermal welding.

18. A manufacturing method of the heat exchanger of claim 9 or claim 10, wherein,

the first substrates are bonded to the second substrates by ultrasonic bonding.

19. A manufacturing method of the heat exchanger of claim 9 or claim 10, wherein,

the first substrates are bonded to the second substrates by diffusion bonding.